PANEL FOR SECTIONAL DOORS

The present invention relates to a panel for sectional doors.

Sectional doors today represent the maximum quality standard for closing an access space to a residential or industrial building.

Panels for sectional doors are currently formed from two suitably profiled metal plates sandwiched together and enclosing foamed polyurethane as insulating agent.

The panels are generally hinged together using intermediate and/or lateral hinges mounted on the ends of the panels by suitable fixing means.

The drawbacks of current panels for sectional doors are the following:

- the hinges fixing the panels together are subjected to tensile, bending, shear and torsional stresses during door operation, and transmit these stresses to the fixing means which consequently require constant maintenance and constitute a critical point, particularly under the action of the wind;
- to enable the hinging of two consecutive doors to rotate perfectly, the centres of rotation of the various hinges positioned along it must be concentric and aligned. Said alignment is difficult to achieve in situ, and even if attainable it would be imperfect because of the stresses existing on the door, and hence on the panels, during its operation. For this reason, hinging is always imperfect, this imperfection resulting with the passage of time in undesirable creaking during movement of the door wing while opening or closing the door;
- equilibrium on the points of contact between two consecutive panels is generally unstable, because of the fact that the contact zone between them is not symmetrical about the hinging centre of the hinges, so generating anti-aesthetic curvatures and lack of alignment of the panel profiles in the longitudinal direction, which become appreciably greater as the panel length increases;
- the production, assembly and installation times of current panels are lengthy, making these operations costly because of the presence of said intermediate fixing hinges, of which at least three in number with four screws each are present for each pair of panels.

The drawbacks of the known art are apparent from the aforestated considerations, particularly as current panels do not fully satisfy the requirements of ease of installation and reliability with time.

The main object of the present invention is to provide a panel for sectional doors, in which the hinging between adjacent panels does not depend on appropriate hinges fixed to the panels.

In a first embodiment, the present invention provides a panel 1 for sectional doors, comprising a profiled outer metal plate and a profiled inner metal plate, connected together to form an interspace occupied by an insulating means, such as foamed polyurethane, characterised by presenting: a first longitudinal end having a more outer substantially circular profile part and a more inner narrow connecting part, and a second longitudinal end opposite the first and presenting a substantially circular narrow-mouthed recess arranged to receive said more outer part of another panel having identical ends such as to couple and hinge the panels together.

In a second embodiment of the invention, the panel is formed from extruded profile bars, one of which forms the first longitudinal end having a more outer part of substantially circular profile and a more inner narrow connecting part, second extruded profile bar forming the second longitudinal end opposite the first and presenting a narrow-mouthed substantially circular recess.

The characteristics of the invention will be more apparent from the ensuing description and from the accompanying drawings relative to some embodiments of a non-limiting character, in which:

Figures 1 and 1A show a first preferred embodiment of the panel in sectional view, assembled and decomposed into its component elements respectively;

Figures 2A, B, C are sectional views with relative external prospects of three respective preferred configurations of the panels of Figure 1;

Figure 3 is a section showing the particular shape of the ends of the panel of Figure 1, together with a section through an anti-friction half-ring which can be incorporated into the panel;

Figures 4A, B, C show respectively two sections and a front view relative to the modalities of assembly of the anti-friction half-rings;

Figures 5A, B are a section and a front view showing the modalities of assembly of two consecutive panels of Figure 1;

Figures 6A, B, C are three sections through that part of the upper ends coupled to two consecutive panels, shown respectively in the normal position, in a position inclined at $\pi/6$ radians and in a position inclined at $\pi/3$ radians;

Figures 7A, B and C are respective sections through another preferred

embodiment of the invention using extruded profile bars; in particular: Figure 7A shows the point of union (hinging) of two profile bars pertaining to two consecutive panels; Figure 7B shows separation at this point of union (with omission of the anti-friction half-ring); Figure 7C shows two profile bars used at the ends (upper and lower) of the sectional door;

Figures 8A and 8B represent overall views of two panels formed from the profile bars, joined to a plurality of interchangeable commercial elements obtainable on the market, such as aluminium glass holders for single and double glass, external and internal rubber sealing strips, and aluminium spacers;

Figures 9A, B, C and D represent four overall sections through possible doors which can be formed with the panels of the preceding figures.

In particular, Figure 1 shows a section through the panel 1 and its main component elements, namely: a profiled metal plate forming the profile part on the outer side 2, of the sectional door, a differently profiled metal plate forming the profile part on the inner side 4, and an internal space bounded by said profiled plates 2 and 4, and filled with foamed polyurethane 3.

The panel 1 for sectional doors obtained in accordance with the present invention by coupling together said profiled metal plates 2 and 4 and insulated with foamed polyurethane 3, which also acts as a binder, comprises (see Figure 4 in particular):

- a first longitudinal end 6 (which is the upper end when in use, and is so-called) having a more outer substantially circular profile part 5 formed by the union of two circumferential arcs 12 and 16 joined together by means of a pair of bent tabs 13 and 14 and radius-joined to the upper end of the panel 6 by the shaped connection profiles 10-11 and 17-18-19 defining the more inner narrow part of the upper end 6 of the panel;
- a lower end 7 having a particular recess profile 8 of substantially circular shape, formed by the union of two circumferential arcs 24 and 28 joined together by means of a pair of bent tabs 26, 27, and radius-joined to the lower end of the panel 7 by portions of shaped fixing profiles 20-21-22-23 and 29-30-31-32;
- a half-ring 9 of anti-friction material seated (see Figure 4) in the portions 23, 24, 28 and 29 of the recess 8. As shown in Figure 4, the half-rings are of limited longitudinal extension and involve only localized points.

Said ends 6 and 7 of each individual panel 1 can be coupled and hinged to the matching ends of other identical panels 1' by being simply inserted manually and thrust in the direction of the height axis without the aid of hinges or other connection means (see top of Figure 5), or by inserting the said matching ends of the individual panels into each other by simply sliding them mutually in the direction of the panel length.

This hinging together of the panels, achieved by virtue of the concentricity of the two matching ends 6 and 7 having said particular matching profiles 5 and 8, is such as to generate an always perfect rotation thereof during the opening and closure of the sectional door.

Said shaped fixing profile portions 20-21-22-23 and 29-30-31-32 present at the lower end 7 are shaped such that the initial portions 22-23 and 29-30 forming the access mouth 8A to the recess 8 are positioned below the centre 25 of said recess 8 and have a minimum distance apart which is less than the diameter of the more outer part 5 of the upper end 6, such as to embrace said part 5 when inserted and prevent its easy disengagement during normal operation of the sectional door.

In a preferred embodiment, said more outer part 5 of the upper end 6 is inclined towards the interior of the space closed by the sectional door, to prevent (both during the closing movement and during the opening movement) the fingers being squashed by the outside of the door, which could otherwise occur between the shaped fixing profile portion 20-21 (Figure 6) of the lower end 7 and the radius-joining portion 10-11 of the upper end 6, during their mutual rotation.

The said inclination of the more outer part 5 (due to the more inner shaped part formed by the radius joints 17, 18, 19 and 10, 11) towards the interior of the space closed by the sectional door, also prevents the fingers being squashed by the inside of the door, which could otherwise occur between the shaped fixing profile portion 31-32 of the lower end 7 and the internal radius-joining profile 17-18-19 of the upper end 6, during their mutual rotation. With regard to the door opening movement, squashing of the fingers by the inside of the door is prevented until the angle between the panels is $\pi/6$ radians, and in any event even if said contained angle reaches its maximum value of $\pi/3$ radians, at which contained angle said profiles 31-32 and 17-18-19 already abut against each other, so preventing their further mutual rotation and

ensuring that any individual pair of panels 1 and 1' cannot fall by separation, mutual rotation exceeding said angle of $\pi/6$ radians does not generally occur at a height lower than 2.50 metres, hence difficultly reachable by a man's fingers. If the panel hinging is provided below 2.50 metres from the floor there could be a risk of squashing. This risk can be: a) either accepted by the manufacturer who must display it by means of a warning on the door and in the operation and maintenance manual; b) or eliminated by applying a semirigid gasket in proximity to the inner lower edge 7 of the panel. Said gasket must suitably extend beyond the edge 19 of the consecutive panel.

In a second preferred embodiment, the sectional panel 1 for doors comprises extruded aluminium profile bars as shown in Figures 7, 8, 9, with each individual panel 1 being formed by joining together an upper profile bar 37, a lower profile bar 38 and a possible reinforcement bar 39, and by a plurality of interchangeable commercial elements such as aluminium glass holders 41, 42 for single and double glass 40, external and internal rubber seal holders 43, 42, and aluminium spacers 45. As in the case of the previously described embodiment, the upper profile bar 37 has a more outer substantially circular part 5', and a more inner narrow connecting part 10', 11', 17', 18', 19'. The same applies to the lower profile bar 38, shaped as said recess profile (here indicated by 8). The arrangement is such that said ends 37, 38 can be coupled and hinged to matching ends of other identical extruded aluminium panels by simple push-fitting or by inserting one into the other by longitudinal sliding, without the aid of hinges or other connection means.

The web abutment profile bar and the ground resting profile bar are indicated by 46 and 47 respectively in Figure 7C.

To further facilitate the sealing of said panels (whether of profiled metal plate or for example extruded aluminium or elastic material varied or non-varied), and their mutual hinging, a plurality of elastic half-rings 9 of self-lubricating material can be inserted into said recess profiles 8, 38 for the whole or part of the panel length, spaced apart by a distance approximately equal to the height of the panel 1.

As can be seen from Figures 9A, B, the invention enables sectional doors of differing composition (homogeneous or non-homogeneous) to be formed. Specifically:

- Figure 9A shows an insulated door 53 (composed entirely of panels 1) with

lower and upper end elements 57 formed from steel profile bars, housing respectively the floor contacting gasket 58 and the upper sealing web gasket 59, both constructed of soft rubber;

- Figure 9B shows an insulated door 54, but with a transparent chamber glass insert (composed of panels 1 and one or more panel inserts of aluminium profile bars as in Figures 8A, B), with lower and upper end elements 57 formed from steel profile bars, housing respectively the floor contacting gasket 58 and the upper sealing web gasket 59, both constructed of soft rubber;

- Figure 9C shows a non-insulated completely transparent door 55 with single glass (composed of aluminium panels with single glass as in Figure 8A), with lower and upper end elements 57 formed from aluminium profile bars, housing respectively the floor contacting gasket 58 and the upper sealing web gasket 59, both constructed of soft rubber;

- Figure 9D shows an insulated completely transparent door 56 with chamber glass (composed of insulated extruded aluminium panels of Figure 8B), with lower and upper aluminium end elements 57, housing respectively the floor contacting gasket 58 and the upper sealing web gasket 59, both constructed of soft rubber.

A characteristic of the present invention is that each pair of consecutive panels, situated in a vertical position, are always in a state of equilibrium, in that the points of contact within the mutual hinging of the profiled ends are symmetrical about the centre of rotation, from which there derives a second but no less important advantage represented by the fact that the intrinsic weight of the panels is discharged to the ground without generating undesirable transverse components to misalign the profiles, as happens with current sectional panels. Moreover when further lateral stresses arise on the panels, generated by the external wind, these propagate uniformly along the entire mutual panel hinging, to result in a uniform deflection less than that of current panels. All this enables doors to be constructed which are more resistant and lasting with time.

Furthermore, with regard to extruded aluminium panels, if a pedestrian door is to be constructed among the constituent panels of a larger door, this will be easier to achieve and will be of better appearance, as misalignments cannot occur between the aluminium profile bars mounted along the perimeter of the pedestrian door. Another but no less important advantage is that assembly of

the movable wing of the sectional door is quicker than by the current known technique, which comprises assembly of the panels by intermediate hinges each fixed with four screws.

The panel of the present invention enables sectional doors to be constructed with improved air and water permeability characteristics in that the mutual hinging of the panels, when in their normal vertical position, presents points of contact in the mutual end portions 12, 22 and 16, 30 which always adhere longitudinally along the entire length of the panel. This prevents free passage of air and water between the outside and inside. In particular, although water particles could pass through said portions 12, 22, they would then fall outwards by gravity because of the arched shape of the hinging positioned at a level higher than that of the water entry point.

The thermal insulation provided by a door constructed with panels of the present invention is greater than the current market standard, as there are no thermal bridges in the hinging between the panels.

Because of its constructional simplicity, the invention presents few problems during procurement, construction, transport, handling, installation or lifting, and offers maintenance simplicity and lower costs compared with current standards.

The production simplicity, the absence of intermediate hinges, and the reduced assembly time on site, result in economy in the cost of the finished product, while at the same time ensuring better results in terms of appearance, performance, durability and safety.

Numerous modifications can be made to the aforedescribed embodiments and their parts can be replaced by others functionally equivalent, without leaving the scope of protection of the following claims.